PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

A54806PCT

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :
F16J 13/02, 15/40, F04B 21/00
F16L 37/10

A1

(11) International Publication Number: WO 92/18794

(43) International Publication Date: 29 October 1992 (29.10.92)

(21) International Application Number: PCT/GB92/00704

(22) International Filing Date: 16 April 1992 (16.04.92)

(30) Priority data:
9108005.1 16 April 1991 (16.04.91) GB

(71)(72) Applicant and Inventor: LEWIS, Edwin, C., II [US/GB]; 13 Finch Place, Spateston, Johnstone PA5 0RL (GB).

(74) Agent: EDE, Eric; Fitzpatricks, 4 West Regent Street, Glasgow G2 1RS (GB).

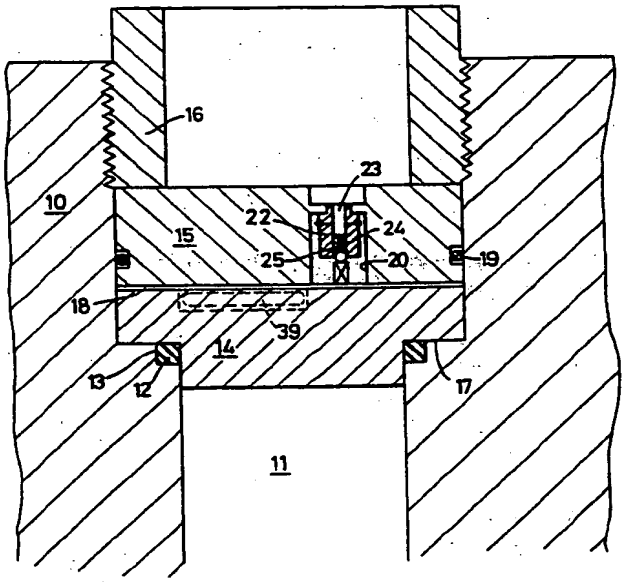
(81) Designated States: AT (European patent), AU, BE (European patent), BR, CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB, GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), NO, RU, SE (European patent), US.

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: PRESSURISED CLOSURE

(57) Abstract

A closure comprises a pair of closure members (14, 15) which when brought together are contained within a body (10) with a sealed space (18) therebetween, means (16) being provided for restraining the members (14, 15) in said body (10), and means (21, 22) associated with the body (10) to introduce a pressurised fluid into the sealed space (18) between the members (14, 15) to cause them to press holdingly against the body (10) and the restraining means (16) thereby to lock the members (14, 15) within the body (10).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CS	Czechoslovakia
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GN	Guinea
GR	Greece
HU	Hungary
IT	Italy
JP	Japan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NL	Netherlands
NO	Norway
PL	Poland
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SN	Senegal
SU	Soviet Union
TD	Chad
TG	Togo
US	United States of America

PRESSURISED CLOSURE

This invention relates to a pressurised closure.

One application of such a closure is to be found in H.P. reciprocating pumps. Such pumps, known as slush pumps are used in the oil production industry for drilling mud pumps. More particularly, the invention relates to cover seals for such pumps. As well as other equipment requiring secure releasable covers, these pumps include valves and other components such as filters through which mud and water pass in a pressurised state. Consequently, the internal parts, i.e. valves, components, and filter screens require to be removed and replaced from time to time and an opening is provided for that purpose. Normally such openings are closed by a plug which seats on an annular seal within a recess in the pump body. The plug is held in place by a plug retainer which is located into the recess and tightly screwed into it via a threaded ring or bolted into the pump body around the opening of the recess.

A disadvantage of such an arrangement is that no matter how tightly in the retainer is screwed, the plug is capable of a small amount of axial movement, especially on the suction sides of the reciprocating pump, and as a result, as the pump operates, the plug is constantly moved off the seal and back on to it, causing the seal to become deformed and worn in several places as it rubs against the pump body and by the plug. In addition, the constantly moving plug can cause fatigue in the retention components.

An attempt has been made to prevent movement of the plug by the provision of radially expanding wedges between the retainer and the plug, but even then, the fluctuating pressure on the inner side of the closure causes axial movement of the seal which consequently is subject to wear by constantly rubbing against the pump body.

An object of this invention is to obviate or mitigate the aforementioned disadvantage.

The closure has other applications, such as to access openings in machinery generally where it is desirable to

have a closure which can be quickly fitted or removed, and to couplings such as hose couplings.

According to the present invention, there is provided a closure comprising a pair of closure members which when brought together are contained within a body with a sealed space between them, means provided for restraining the members in said body, and means associated with the body to introduce a pressurised fluid into the sealed space between the members to cause them to press holdingly against the body and the restraining means to lock the members within the body.

The pressurising fluid is introduced into the sealed space between the closure members by any means that will allow the introduction and maintenance of pressure in the sealed space. In some applications of the device, permanent pressure hookups and or manifolding might be desired and or incorporated. Such a situation might be in equipment where simultaneous opening/closing of many closures would be required.

The pressure inlet requirements for the closure are such that standard/conventional pressure handling apparatus can be used, i.e. pipe/tube, fittings, valves, pumps, couplings, etc. However, it is preferred that the means of introducing the pressure be quick since one aspect of the closure's design is its ability to allow rapid entry into equipment for service.

Therefore, a quick release fitting such as that detailed in Patent No GB 2 190 170 B is preferred. This fitting, comprises, in combination a fitting body having an axial through passage the inner end of which is closed by a valve releasably seated against the fitting body and releasable to open the passage as a fluid channel, one or more radial fluid outlet passage means associated with the central passage for the injection of fluid into the internal openings of the radial passages in the fitting body, check means associated with the external outlets of the radial passages of the fitting body to permit movement of fluid in one direction only thereby to eliminate axial load on the

fitting, and an inlet for nozzle for injecting pressurised fluid into the fitting body, said nozzle being adapted for location in the central passage of the fitting body and having a longitudinal fluid inlet passage which bends through an angle to exit from the side of the nozzle and align with the radial fluid inlet passage means of the fitting body the nozzle also having a separate p.s.i. equalising bleed hole which extends through the nozzle from the end of the nozzle which locates in the fitting body to further prevent axial load on the fitting when it is pressurised.

The body may be an access opening in a machine body and the restraining means may be a means which co-operates with the access opening to prevent removal of the closure members when located in the opening. The machine may be a pump or other pressurised vessel in which the area inward of the closure is subjected to a pressure or fluctuating pressures, and wherein the pressure between the closure members is greater than the maximum pressure inward of the closure.

The body may be a collar of a coupling, in which one closure member is attached to the collar and is engageable by the other closure member which, when coupled is holdingly engaged by restraining means on or associated with the collar.

The body may be the frame of a door, window hatch or inspection port.

The body may have multiple openings where multiple closures are linked together allowing open and closing actions to be performed in unison.

The body may be such that the closure is an integral part of the body or it may be such that the closure is attached to the body and sealed in such a way that the closure becomes an integral part of the body.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a sectional elevation of a portion of a machine body housing a closure according to the invention;

Figs. 2,2a,2aa,3 and 4 are sectional elevations of modified machine body closures;

Fig. 5 is an elevation of hose coupling having a closure according to the invention;

Fig. 6 is a sectional, half-elevation showing the hose parts coupled;

Fig. 7 is a sectional elevation of an inspection port having a closure according to the invention;

Fig. 8 is a sectional elevation of a variation of the closure that forms a one piece assembly;

Fig. 9 is a sectional elevation of a pressure regulating/relief mechanism;

Fig. 10 is a detail of Fig. 9 to a larger scale;

Fig. 11A is a sectional elevation of a portion of a machine body housing a modified closure;

Fig 11B is a detail of Fig 11A to a larger scale, and

Fig 12 is a detail showing an arrangement of multiple closures according to one aspect of the invention that are linked to a common pressure source via a pressure manifold.

Referring to the drawings, in which like parts are identified by like numerals and firstly to Fig. 1, a machine body 10, for example, a pump body has an opening 11 therein which has an annular seal 12 on a seating 13 and a closure comprising a pair of plugs 14, 15, and a plug retainer 16.

In known closures, only one plug 14 and the plug retainer 16 are provided and the retainer has to be screwed tightly into the opening to hold the plug 14 firmly against a seating 17 on the body adjacent to the seal 12.

In this embodiment, the plug retainer 16 need only be screwed in sufficiently to engage the upper plug 15 because a pressure medium is introduced into the space 18 between the plugs 14 and 15 to force them apart and into tight holding engagement against the seating 17 and retainer 16 respectively. The outer plug 15 has a peripheral seal 19. The pressure medium may be any fluid such as a gas, but is preferably a viscous liquid such as grease. It is introduced into the space 18 which is bounded by seals 12, 19 through a quick release valve fitting comprising a

fitting (valve) body 22 incorporated into a recess 20 in the outer plug 15, and a nozzle 21 for location in the body 22. The nozzle 21 and valve body 22 are shown more clearly in Fig. 2. The valve body 22 has a central through passage 23, the inner end of which is fitted with a plug, e.g. a threaded socket head 24 which has a small bore central passage 25 therethrough and which terminates adjacent to a check valve such as a ball 26 spring urged at 27 against a seat 28 to close-off the passage 23. The valve body 22 also has a series of radial through passages 29 communicating with the central passage 23 whereby pressurising fluid entering the valve 22 exists into space 18 via the radial passages 29 and recess 20. A check means, conveniently an o-ring 30 is stretched around the exterior of valve body 22 to cover the outlets of the radial passages 29. The o-ring 30 gives as the pressurised fluid exits from the valve.

Valve body 22 may be inserted into plug 15 from above or below the plug. When the valve is inserted from above, pressure in space 18 tends to force the valve body out of the plug and the valve body must be retained in the plug e.g. by screw threading.

In order to relieve the pressure in space 18, a Hex Wrench or similar tool e.g. and Allen Key is located in the central passage 23 of the valve 22 to screw the socket head plug 24 further into the valve and thereby unseat the check valve 26 and open an exit for the pressurising fluid through the socket head passage 25 and central passage 23. If the pressurising fluid is viscous such as grease, it will simply ooze out rather than spurt out.

The pressurising fluid is inserted into the valve by a nozzle 21 which has a fluid passage 31 having an axial run and a bend to exit radially, and being designed so that the radial outlet 32 feeds into the radial passages 29 in the valve 22. The nozzle also has a pressure equalising bleed hole 33 which has an axial run from the inner end 34 of the nozzle and a 90 deg bend to exit through the side of the nozzle at 35 to atmosphere. Thus, if as the nozzle is passing pressuring fluid via passage 31/32 into space 18 via

valve 22, the check valve 26 is not seated in the seat 28 and leakage of the fluid within the space 18 escapes by passing around the check valve 26, fluid can escape through a separate passage 33 in the nozzle thus alerting the operator that a leaking situation exists.

The nozzle is for example, attached to a H.P. source such as grease gun.

The plugs 14, 15 may have an aperture therein for insertion of a rod for removing the plug, or a handle 39 which is normally located in a recess in the surface of the plug.

Referring now to Fig. 2 which shows a modified closure; the lower plug 14 incorporates the seal 12' around its periphery which is not subject to the increased extrusion that is possible at seat 12 whenever the intimate seating on shoulder 17 is restricted due to contamination solids in the interface at shoulder 17. The plug 14 also includes a handle 39 but the handle has a slideable stem 40 contained in an aperture 41 which increases in diameter towards the outer side of the plug 14. A seal 42 around stem 40 normally seals the aperture but when the stem is moved outwards the seal moves out of the area of the aperture 41 and is 'broken' which equalizes the pressure on both sides of the plug thereby permitting an easy removal of the plug. This pressure release will also allow the release of any internal pressure in fluid passage 11 by pushing outward when plug 15 is removed. The hand grip part 43 of the handle 39 normally lies on the outer surface of the plug 14 and a recess is provided in the inner side of the outer plug 15 to accommodate the handle part 43 and stem 40.

In this embodiment an insert 50 is located in the opening 11 of the pump body 10 by screw threaded engagement at 51, although the insert may be otherwise located in or on the body by welding, adhesive bonding, pinning, bolting or other suitable means. The insert 50 seats on seat 17 over seal 12 and has internal dimensions to receive the plugs 14, 15 and an appropriate plug-retaining arrangement which, in this embodiment comprises bayonet-type recessed 16'.

An additional variation of the insert 50 is shown in Fig 2a. In this embodiment a closure body/housing 50' is retained over the opening 11 of the pump body 10 using a mounting adapter 90. The mounting adapter 90 can be attached to the pump body by any means such as threaded fasteners as shown.

Also illustrated is an arrangement where the mounting adapter is constructed using multiple elements. In such a manner of design, each element is chosen to maintain structural integrity while improving other desired properties such as weight reduction. The top element 91 and the shoulder element 92 can be constructed of a material that allows high bearing capabilities such as a metal, while the spacer elements 93 and 93' can be made from lighter rigid materials such as fibre reinforced plastics which would lighten the assembly considerably.

In such an embodiment, dimensional accuracy would however be critical since the assembled integrity of the mounting adapter could rely on compression between each of the elements in the assembly. In some instances, i.e. closure assemblies attached using conventional ring joint gaskets, this would be difficult due to the gap variations which can occur with the use of these conventional ring joint seal arrangements.

In this case, the body/housing 50' could be configured as shown in the body/housing 50''. The bottom of the body/housing 50'' is configured to incorporated a sealing element 94. This embodiment ensures that the distance between the shoulder element 92 and the pump body 10 can be easily controlled since the body/housing 50'' remains in intimate contact with the pump body 10.

In Fig 2aa this same seal configuration is shown as a separate element, seal body 95, whereby the advantage of maintaining a controlled gap between the body/housing 50'' and the pump body 10 is also possible. Such an arrangement would allow an assembly incorporating a solid mounting adapter 90 to be replaced with a lighter multiple element mounting adapter, elements 91,92,93,and 93'. at a later

date. This type of seal arrangement can also be used in any application where it is desirable to replace a ring joint gasket with a seal arrangement that would eliminate the problem of gap variations. A single side variation of the seal body 95' can be used whenever this seal arrangement requires an attachment to an assembly where only one side of the seal arrangement is the ring joint type. The other side can be configured to adapt to the sealing configuration of the mating component. Hence, the single side variation of the seal body 95' can itself be used as a seal adapter, ring joint to other types.

The inner plug 14 seats on a seating 17' and the outer plug 15 has ears 44 in the form of a bayonet-type periphery for location in complimentary recesses 16'. Thus the plug retainer 16 is not required.

The outer plug 15 has the quick release pressure fluid fitting 22 and in use, pressurised fluid is contained in the space 18 between the plugs bounded by the peripheral seals 12' on the inner plug 14 and 19 on the outer plug 15. Thus, inner plug 14 is pressed firmly against its seat 17' and outer plug 15 is pressed firmly against the bayonet fitting 16'. After use, when the pressure has been released by actuation of socket head 24, the outer plug 15 rotated and removed, and the handle 39 is raised to break the suction on the inner side of the inner plug 14 so that it too can be removed from the opening 11 in the pump body. A similar such pressure release can also be added to plug 15 if desired to facilitate its easy removal as well. The pressure equalizing, handle-operated slideable stem 40, illustrated in Fig. 2 as part of the inner plug 14 may be duplicated on the outer plug 15, particularly where the pressuring medium is a viscous fluid. It is not required, however, since plug 15 can be slowly drawn out or pumped out of the recess if necessary.

In a further modification, Fig. 3, the plugs 14 and 15 are held in the opening 11 of the body by a slideable stop plate 51 which locates across the opening 11 but can be retracted to allow insertion of the plugs 14 and 15. When

pressure fluid is inserted into space 18 between the plugs bounded by seals 12, 19 the lower plug 14 is pressed firmly against a seating 17 on the body and the outer plug 15 is pressed against the slide plate 51.

The plate 51 has an aperture 52 therein which when the plate 51 is located over the opening 11 registers with the passage 23 of the valve fitting 22 to permit entry of the nozzle 21 into the valve fitting 22.

Fig. 4 illustrates a closure in which the outer plug 15' has a hollow central opening 55 and an inner annular neck 56 which extends into a recess 57 in the outer face of the inner plug 14'. A seal 19' extends around the neck 56. Thus, the space 18 to receive the pressurised fluid between the plugs 14', 15' is in the form of an annular space bounded by three seals 12, 19 and 19'.

The purpose of the opening 55 in plug 15' is to give access to the inner plug 14' through which one or more probes 58 or the like can be passed in the interior of the pump body 10.

The closures hereinbefore described are for use in openings provided in the body of a machine or vessel. Where the machine or vessel is pressurised and subject to a fluctuating pressure, the pressure of the fluid inserted into the space 18 between the plugs and bounded by two or three seals 12 or 12' and 19/19' can be set greater than the pressure inward of the inner plug 14 so that the inner seal 12 is not subjected to any movement due to the fluctuation of the internal pressure. Where the machine or vessel is not subjected to fluctuating pressure, the closure simply provides a quick means of locking and releasing the closure. The closure, however, has other applications outwith the body of machines or vessels and the concept of the pressurised closure can be used for other types of opening on other devices or apparatus, e.g. to secure a door, inspection port or the like, or as a coupling. One example of the closure as a coupling (for a hose or pipe) is illustrated in Figs, 5 and 6, wherein two lengths of hose or pipe, 60 are provided, to the end of each of which is

secured tubular coupling parts 14", 15" e.g. by screw threading 61 or other suitable means.

Coupling part 14" is fixedly attached to the hose or pipe 60 and has a body in the form of a collar 62 which is rotatably mounted thereon and retained by a retaining ring 63. The collar 62 extends longitudinally beyond the coupling part 14" to form part of a locking mechanism in that the collar 62 has recesses 16' on its inner face which acts as a bayonet fitting for ears 44 on the coupling part 15". The coupling part 15" has a neck 56 which has a peripheral seal 19' and projects into a recess 57 of the coupling part 14".

An annular space 18 is provided between the coupling parts 14", 15" to receive pressurised fluid from a quick release valve fitting, the valve body 22 being located in the collar 62 and bounded on each side by a seal 12' on coupling part 14" and seal 19 on the coupling part 15". Thus, the space 18 is bounded by three seals 12', 19 and 19'. On pressurisation of space 18 the coupling parts 14", 15" are forced relatively apart against a shoulder 17' of the collar 62 and against the recessed 16' containing the ears 44 respectively.

As the collar 62 is rotatable about the coupling part 14" (before pressurisation of space 18), the coupling parts 14", 15" can be engaged or disengaged without the need to rotate either hose or pipe 60.

In those instances where hose or pipe rotation is not a consideration, the collar 62 and coupling part 14" may be unitary, in which case, seal 12' and retaining ring 63 are not required.

The coupling parts 14", 15" can be used for coupling items other than hoses or pipes; for example, if the parts 60 shown in Fig. 6 were the walls of two vessels to which parts 14", 15" were either attached or integral it is clear that the two vessels could be coupled together and the coupling locked by the introduction of pressurised fluid.

In Fig. 6, the valve body 22 is shown disposed transversely or radially of the collar 62, but where

necessary or convenient the valve body 22 may be disposed longitudinally or axially of the collar.

Referring to Fig. 7, the closure is applied to an opening such as a door, hatch, window or inspection port. A frame 70 has an inner peripheral seat 17 against which an inner closure 14 is located, the closure 14 having a peripheral seal 12'. An outer closure 15 is located behind the inner closure 14 and held in position by a suitable restraining means which in this embodiment is a bayonet type fitting 16' on the frame 70 and ears 44 on the closure 15. The closures 14, 15 may be relatively thick members as shown on the upper portion of Fig. 7, to provide only a narrow pressurisation space 18 or therebetween or they may comprise or incorporate panels formed of relatively thin panes or sheets 71 of transparent glass or plastics which have a relatively large pressurisation space 18.

With reference to Fig. 8, the closures 14, 15, and 16 may be linked together to provide a closure that assembles as a single unit. In such a configuration, the means of coupling of plugs 14 and 15 is accomplished in such a manner that the axial movement of plug 14 relative to plug 15 is maintained. Such a means can be provided as shown by fastener 64. The linked arrangement of 15, 16 may be accomplished by any means, such as some form of a mechanical fastener like fastener 66, or a more permanent assembly such as that provided by processes such as welding or adhesive bonding. In addition, 15, 16 can be configured in such a manner that the functions of both elements are incorporated in a single element such as 15'". In addition, the machine body 10 may be configured in such a way that the securing means for the closure is embodied in a separate locking plate 67.

The valve body 22 may be configured in such a manner that it lies outwith the outer plug 15 in an assembly such as element 65 which can serve as a handle if desired. In such an embodiment, the outer surface of element 65 can be roughened to facilitate gripping.

Pressurised fluid is introduced into the space 18 between the closures 14, 15 bounded by seals 12' and 19 via a quick release fitting the valve body 22 of which is contained in a compartment 20 of the frame 70. The pressurising fluid may be transparent or opaque so that particularly where transparent panels 71 are provided, visibility can be permitted or denied while the closure is pressurised.

An advantage of the closure or coupling as hereinbefore described is that the pressurised fluid between the closure members is at a higher pressure than the other pressures in the system and also at least two seals are provided to contain the pressurised fluid between the closure members. Thus, even if one seal fails and the closure loosens leakage will not occur because of the second seal which is still intact. This is particularly advantageous in hazardous or critical environments.

In addition, the pressurised closure prevents movement of the inner seal 12 and a static-seal situation exists in a pressure vessel where fluctuating dynamic pressures occur. This is especially so where the internal pressure fluctuates between a negative or vacuum pressure and positive pressure which is higher than the external pressure; normally in such situations, the seal tends to move towards the direction of low pressure, i.e. it reciprocates towards the lower pressure.

A further advantage is that only two tools are required to operate the quick release fitting, namely a gun to insert the pressurised fluid and a tool (e.g. Allen key) to remove plug 24 and release the pressure.

In the described embodiments, as in other such apparatus, there maybe a need to regulate the inlet pressure of the fluid for safety reasons. This can be achieved through an internal relief mechanism which is `in line' between the pressure source (e.g. grease gun) and nozzle 21.

One such mechanism is illustrated in Fig. 9 which shows a casing 73 of which the nozzle 21 is an integral part and in which the internal relief mechanism is contained. The

casing 73 has an inlet 74 for connection to the pressure source (not shown). The pressurised fluid passes through inlet 74 to the fluid passage 31 of the nozzle 21. The internal pressure regulating/relief mechanism includes a piston 75 which is subjected to the pressurised fluid and is moveable as the pressure increases. The piston 75 acts against a body 76 which in turn acts against spring pressure, e.g. mechanical springs 77 and said spring pressure can be adjusted to a predetermined load by an adjusting mechanism such as a threaded cap 83.

The piston 75 has a fluid passage 78 (see Fig. 10) which has an axial run and a bend to exit through the side of the piston at 79. This exit 79 is normally blocked by the body of the casing 73 but as the pressure increases and the piston moves away from the pressure, restrained by the springs 77, the exit 79 will eventually meet a recess 80 which leads to atmosphere via a groove 81 and vent 82.

In this way, no additional fluid can pass through nozzle 21 once the predetermined pressure in the pressurised space 18 has been reached. The appearance of vented fluid will alert the operator to this.

Also, provided is a means by which the internal pressure in the supply hose can be vented from the hose prior to removal of nozzle 21 from the passage 23 in the valve fitting body 22, the purpose being to prevent damage to seals 84 which are mounted on the nozzle on each side of exit 32, Fig. 9. The venting mechanism comprises a ball check valve 85 which is unseated by a pin 86 activated by a handle 87 which pivots at 88. Thus, as the operator pulls the handle to remove the nozzle 21 from the passage 23, the handle initially pivots to unseat the check valve 85 and pressure is vented by a passage 89 to atmosphere.

It is obvious that the pressure regulating/relief mechanism 75 to 83 can be at any location in line between the nozzle 21 and the pressure source. It is also obvious that the most suitable arrangement is as an integral part of the nozzle so that the pressure regulating/relief mechanism

cannot be detached from the nozzle. Also, the casing 73 can thereby be attached to different pressure sources.

The hose pressure relief mechanism 85 to 89 can likewise be at any suitable location in line with the pressure source and the nozzle, but clearly the preferred arrangement is as an integral part of the nozzle to allow the pressure in the hose to be released with the same action which withdraws the nozzle.

Although it is shown that piston 75 is inserted into body 76, these could be integral without altering their function.

In those cases where no adjustment is allowed or preferred, the cap 83 can be an integral part of the casing body which for manufacturing reasons is made in two parts 73, 73'.

The intention of the pressure regulating/relief mechanism is to limit the maximum pressure in the pressurised space 18 between the plugs 14, 15, consequently it is possible to incorporate into the outer plug 15 a pressure regulating/relief mechanism such as 75 to 83 as described with reference to Figs. 9 and 10. However, by doing so, additional openings and seals are required in plug 15.

In those instances where the closure is subject to external conditions that might cause the pressure in the space 18 to increase during service, i.e. temperature, or system pressure spikes acting on plug 14, a regulating/relief mechanism such as 75 to 83 would be of benefit as an integral part of the outer plug 15.

Where the closure opening has been damaged or worn out or where the diameter of opening is greater than that of the inner and outer plugs 14, 15, an adapter sleeve (not shown) or an adaptor piece such as insert 50 (Fig. 2) can be inserted into the closure opening.

In each of the above instances, the application of the invention has been illustrated in single situations. Referring now to Fig 12, the invention is shown in use where more that one closure is linked to a common or manifold

pressure source which allows simultaneous locking and unlocking of multiple closures on a single or multiple device. The pump body 10 (or pump bodies 10) can be fitted with closures having a common pressure inlet 95. Each individual closure is linked to the others via a piping 96 connection, or a manifold porting 97 arrangement.

Pressure inlet(s) 98 may also be included in any one or all of the closures (as previously illustrated in other Figs.) if desired in lieu of a common pressure inlet 95. Therefore, pressure applied to any of the closure inlets will be conveyed to all closures so piped or manifolded. This arrangement is especially beneficial in those cases where multiple assess ports were desired without the additional time burden required if each had to be opened or closed at the same time. In addition, in those cases where it was desired to record the pressure status of the closures in an assembly, a single manifolded or piped pressure system would require sampling at only one point.

It is to be appreciated that the present invention enables a user to check the pressure in space 18 during operation of the pump, thus eliminating down time of the pump.

It has been found that the straight edges of the plugs 14,15 are prone to sticking upon insertion in the cylindrical recess in the body 10. A further embodiment of the present invention is shown in Figs 11A and 11B. Referring to Fig 11A plug 14 is shown as having a partially spherical outer edge which offers a limited scope of alignment to eliminate the afore mentioned problem. Plug 15 is shown to have a completely spherical contact surface with the body 10 which allows the plug to pass through the body without hindrance.

As shown in Fig 11B, the corners C and D of the plug contact surface would exhibit similar sticking characteristics as the straight contact surfaces and therefore the contour of the seal in the groove may be proud of the contact surface in order to counteract the sticking

effect of the corners C and D of the contact surfaces of the plugs 14, 15.

CLAIMS

1. A closure comprising a pair of closure members which when brought together are contained within a body with a sealed space therebetween, means being provided for restraining the members in said body, and means associated with the body to introduce a pressurised fluid into the sealed space between the members to cause them to press holdingly against the body and the restraining means thereby to lock the members within the body.

2. A closure according to claim 1, wherein the body is a collar of a coupling, in which one closure member is attached to the collar and is engageable by the other closure member which, when coupled is holdingly engaged by restraining means on or associated with the collar.

3. A closure according to claim 1, wherein the body is an access opening in a machine body.

4. A closure according to claim 1, wherein the body is a frame of a door, window hatch or inspection port.

5. A closure according to any one of the preceding claims, wherein the machine is a pump in which the area inward of the closure is subjected to a pressure or fluctuating pressures, and wherein the pressure between the closure members is greater than the maximum pressure inward of the closure.

6. A closure according to claim 3, wherein the restraining means co-operates with the access opening to prevent removal of the closure members when located in the opening.

7. A closure according to any one of the preceding claims wherein the body has multiple openings and multiple closures are linked together thus allowing open and closing actions to be performed in unison.

8. A closure according to any one of the preceding claims wherein the body is integrally connected to the closure.

9. A closure substantially as hereinbefore described with reference to and as shown in the accompanying figures.

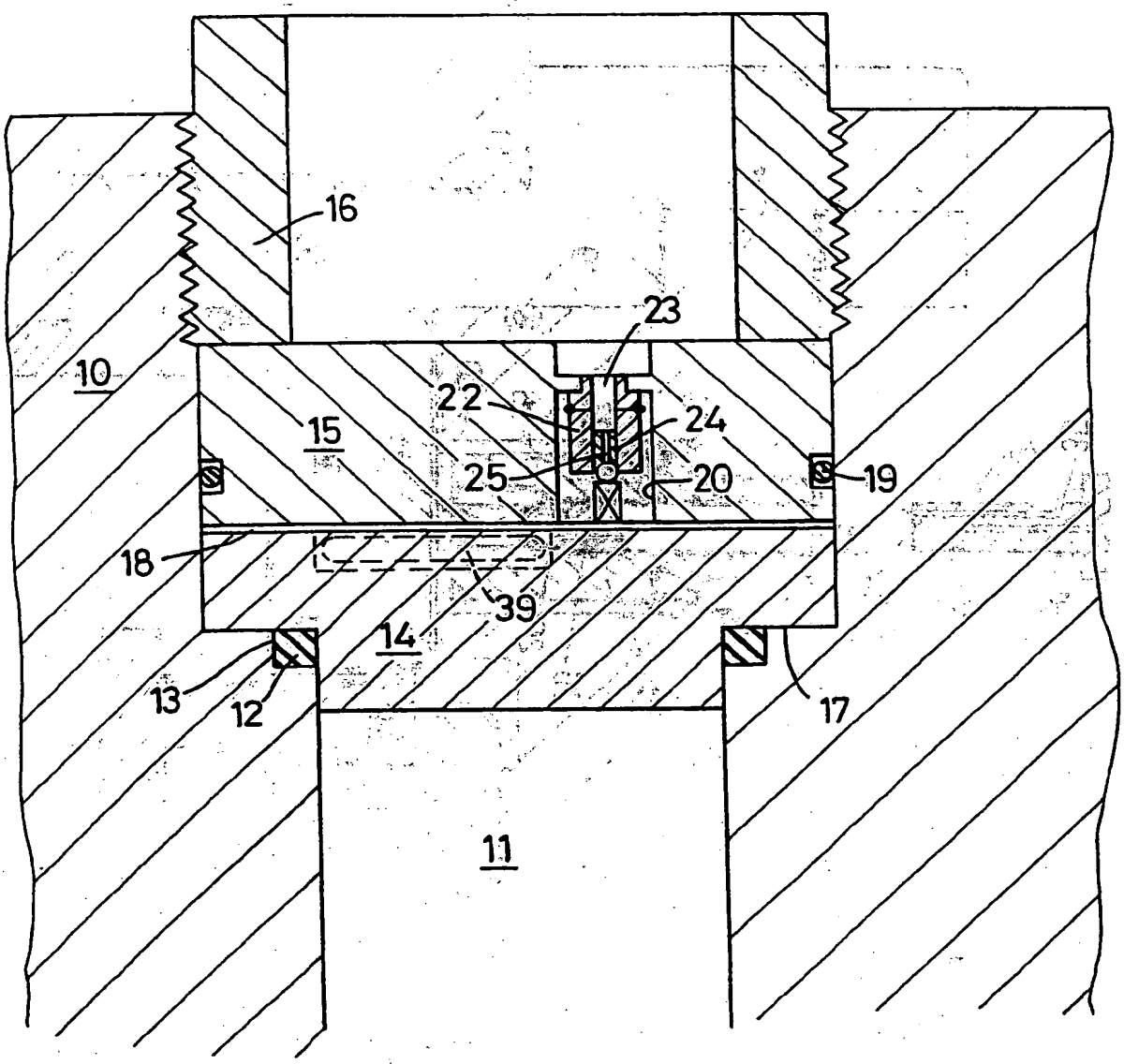


Fig. 1

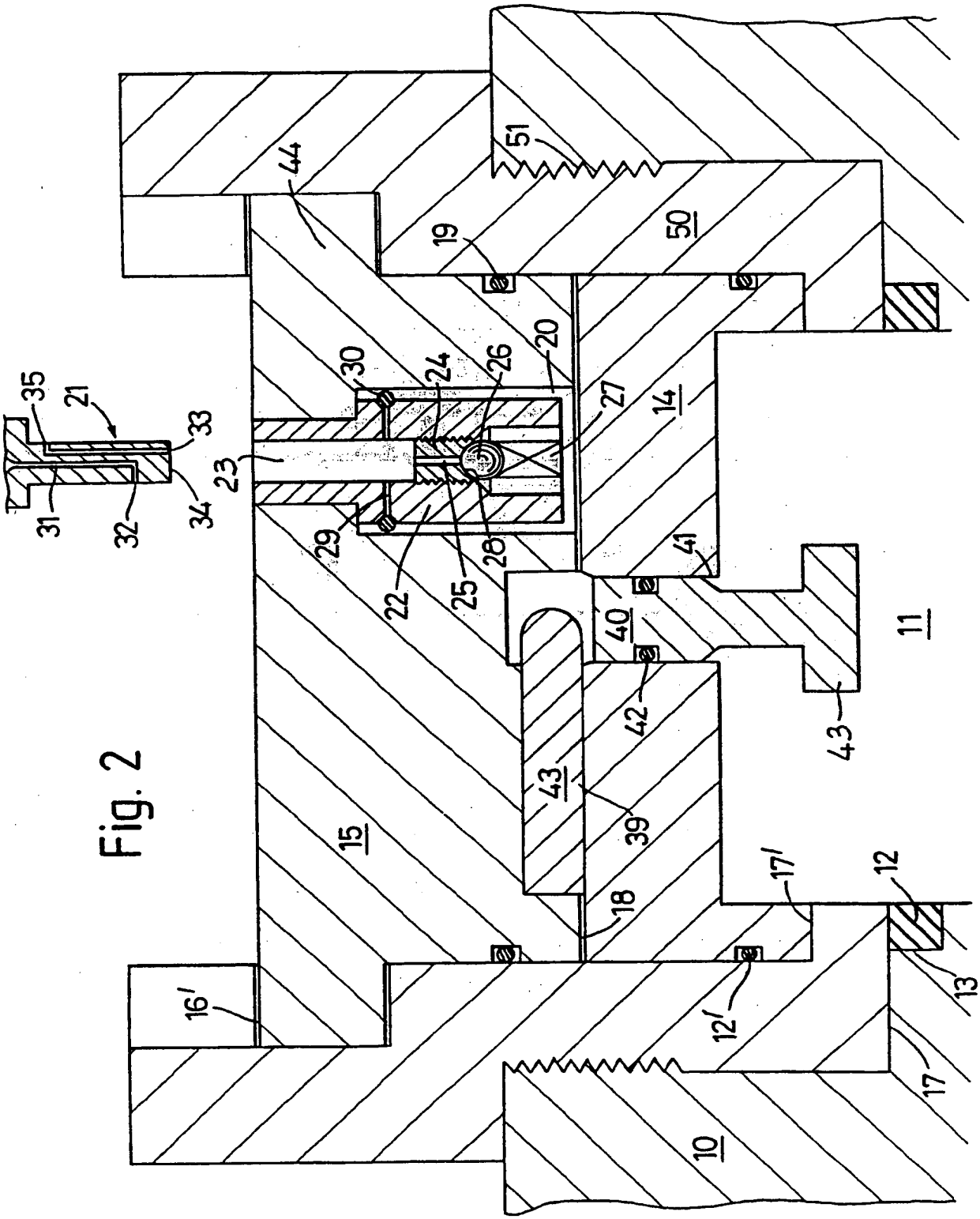


Fig. 2

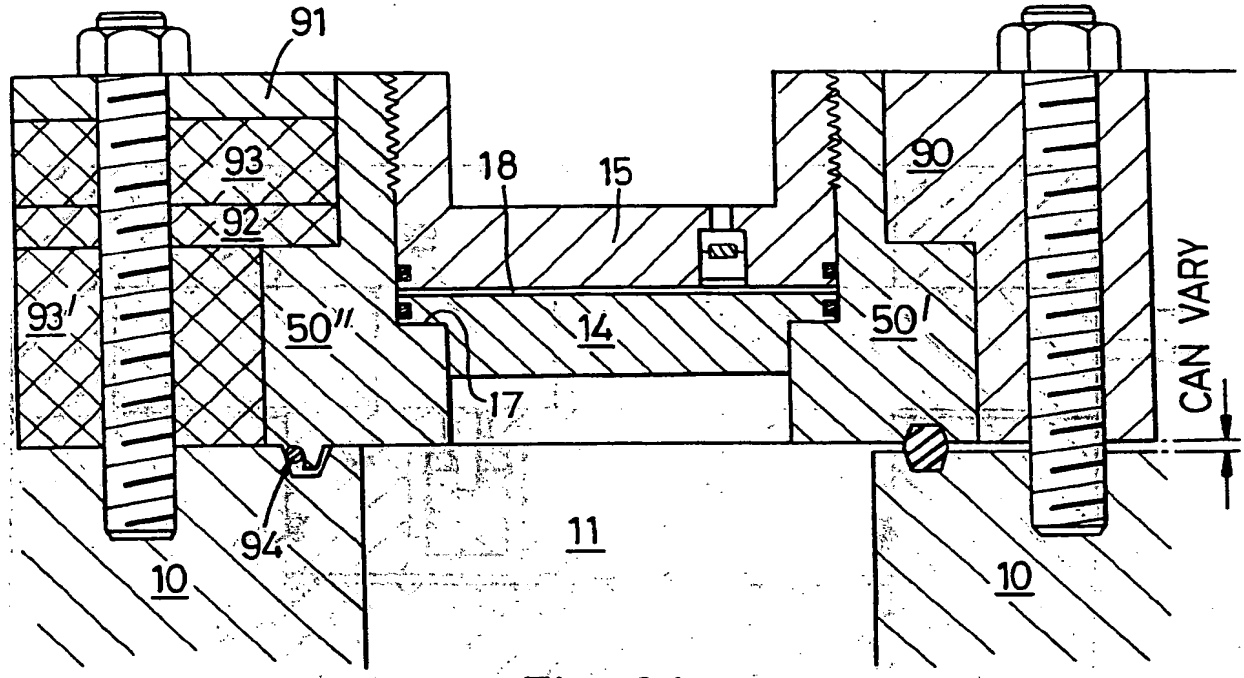


Fig. 2A

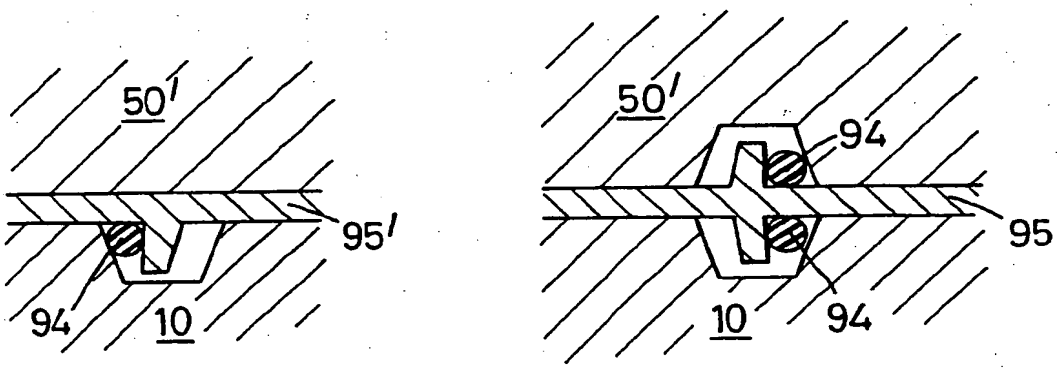


Fig. 2AA

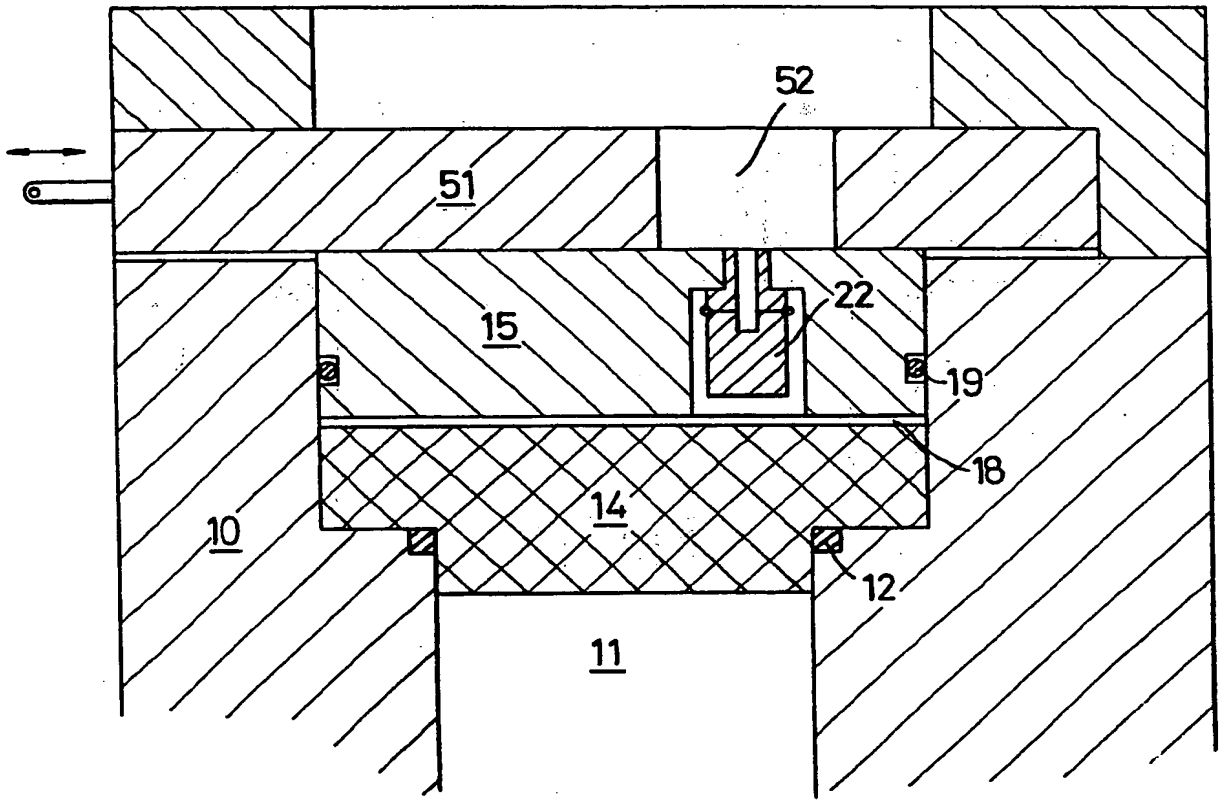


Fig. 3

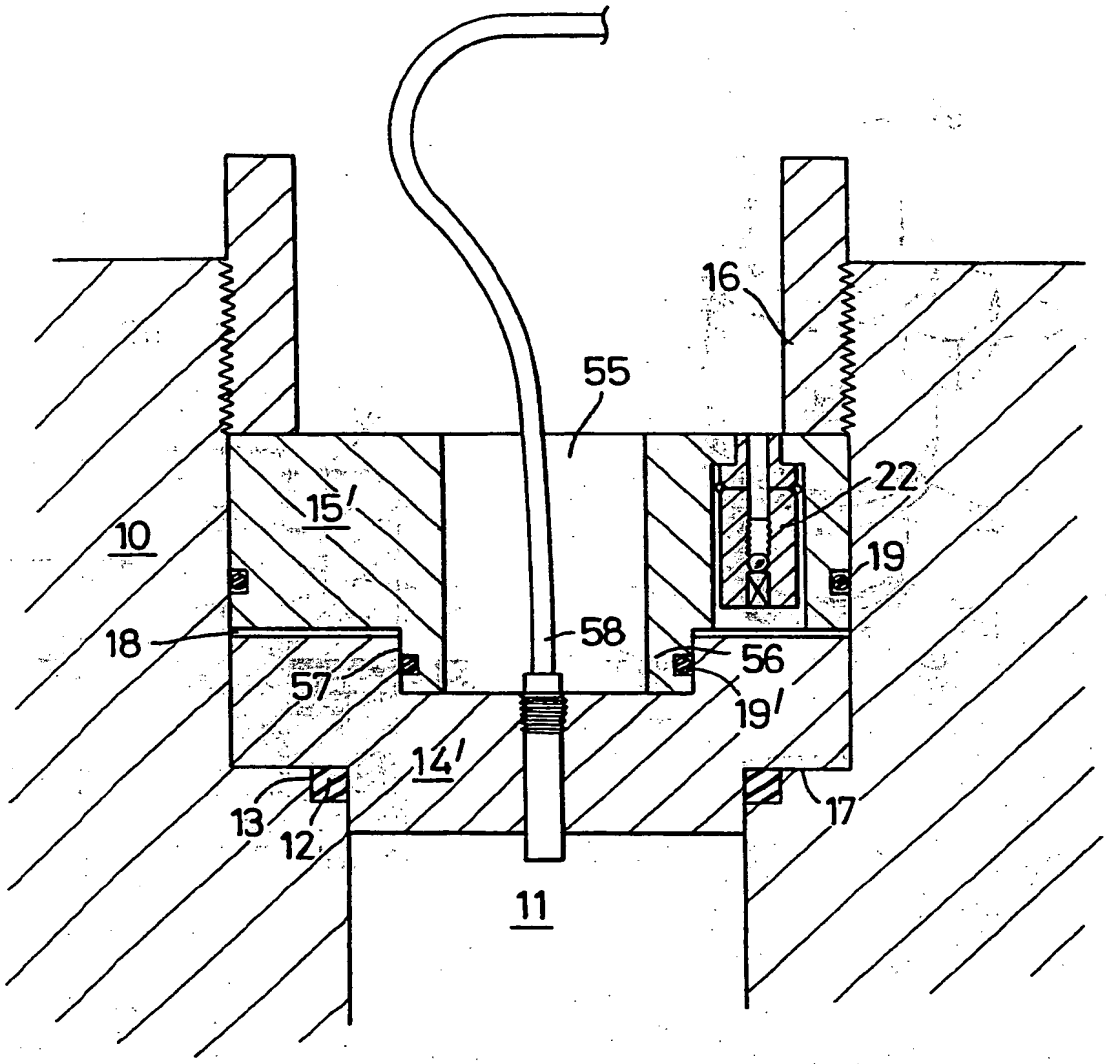


Fig. 4

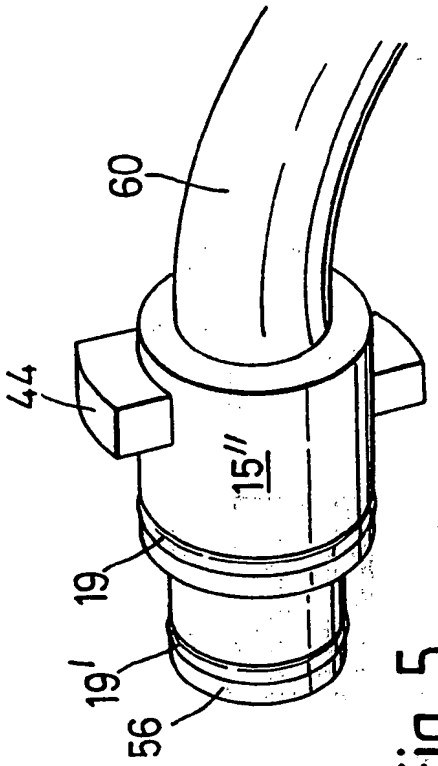
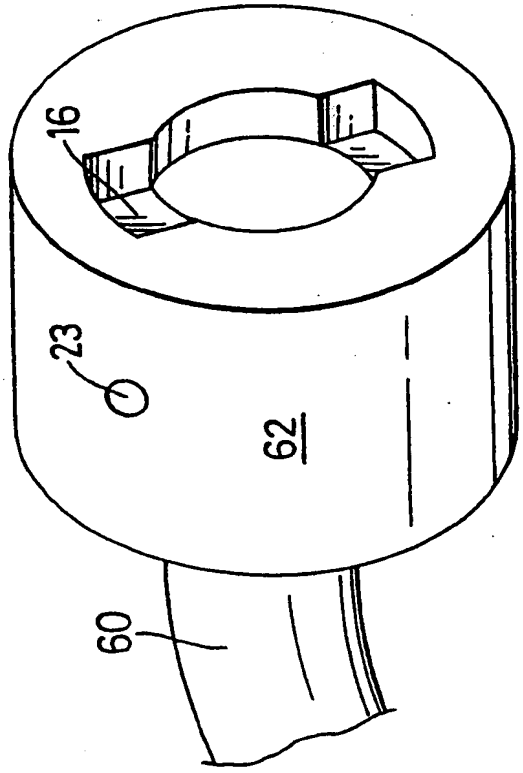


Fig. 5



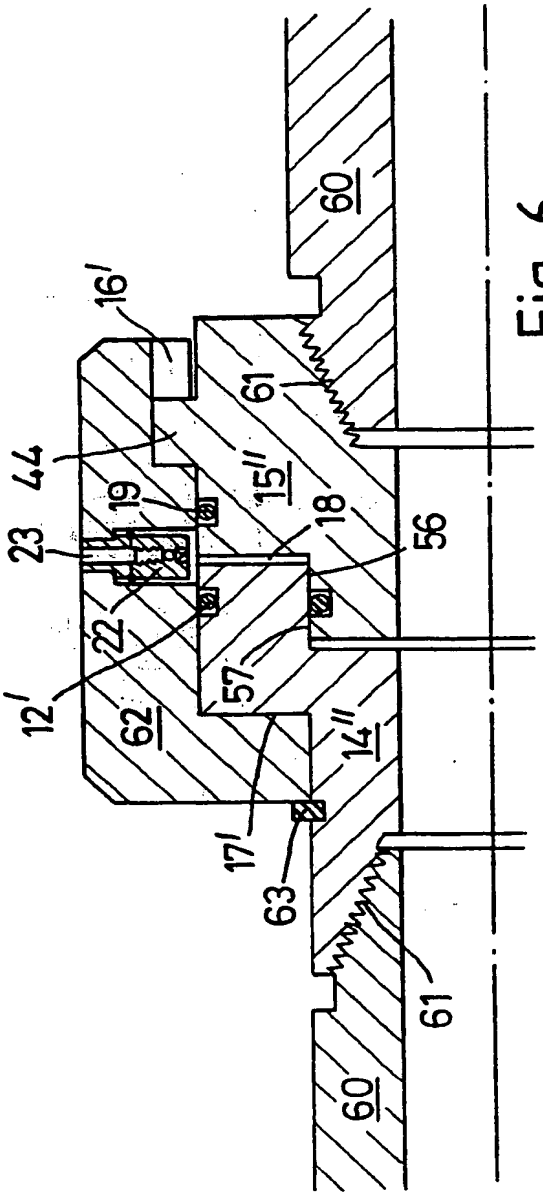


Fig. 6

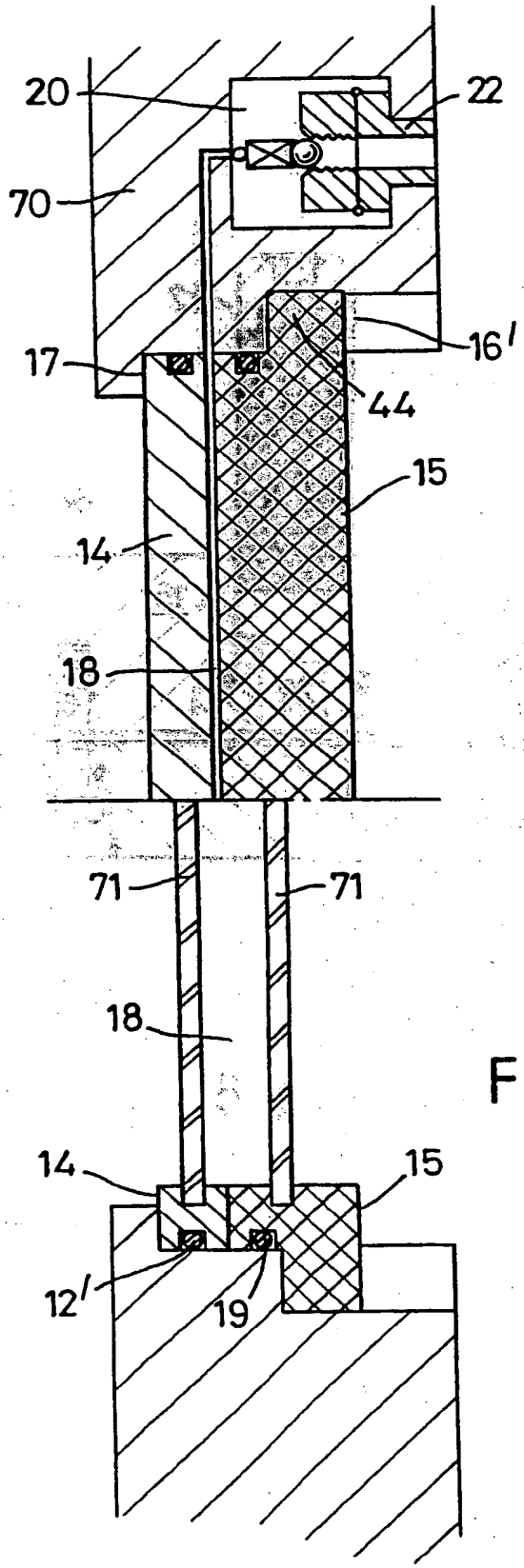


Fig. 7

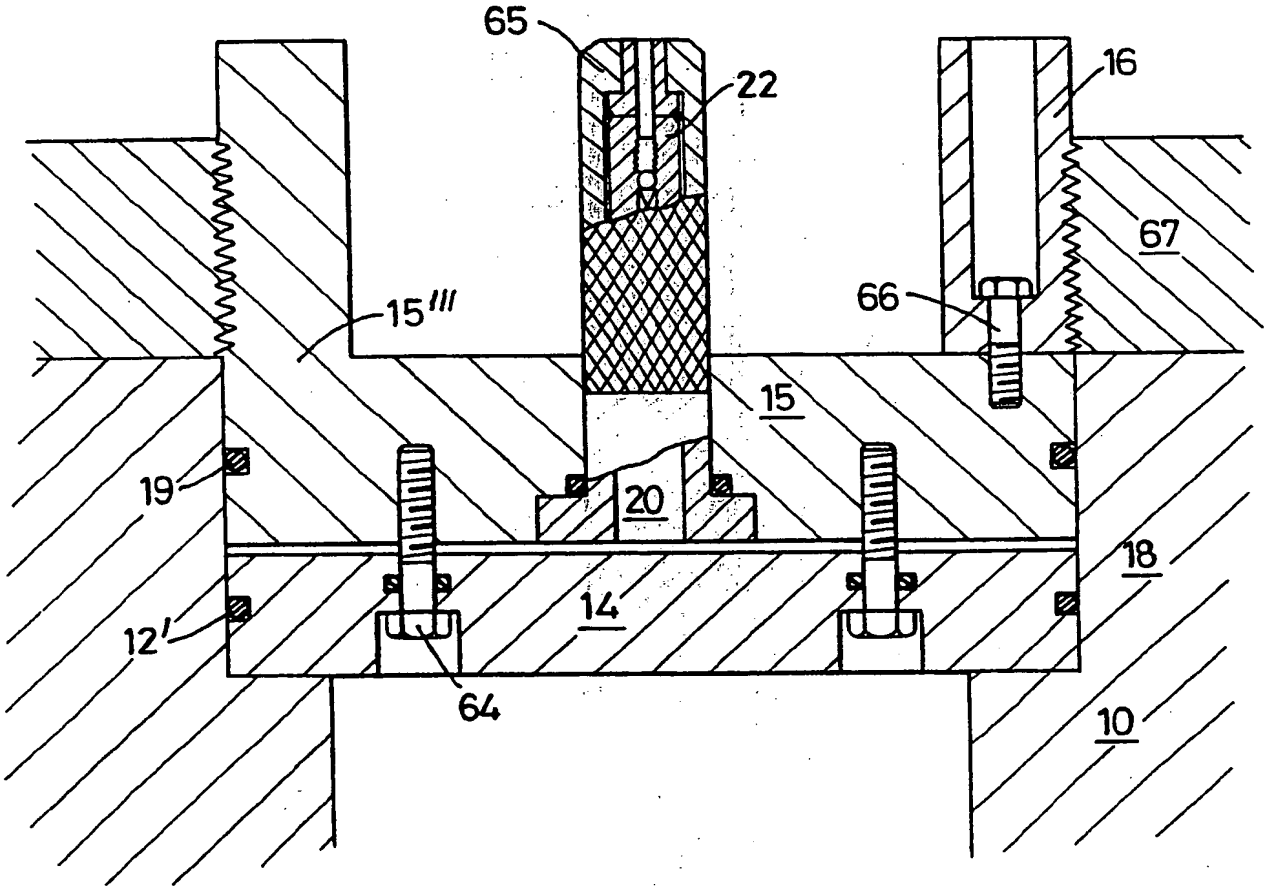


Fig. 8

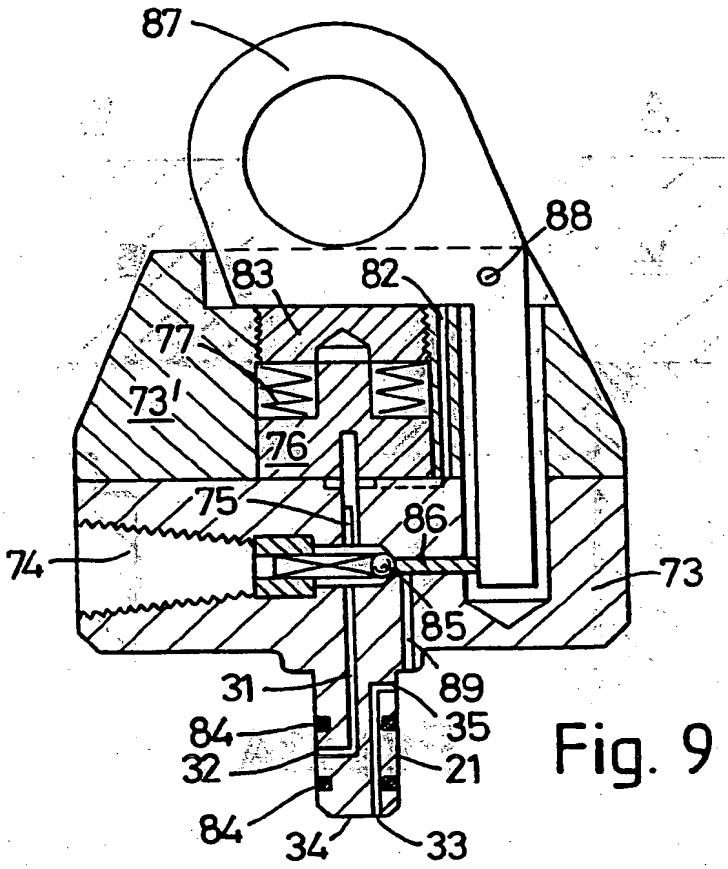


Fig. 9

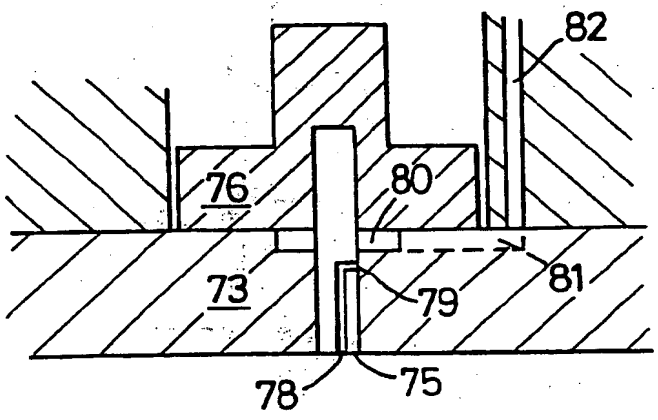


Fig. 10

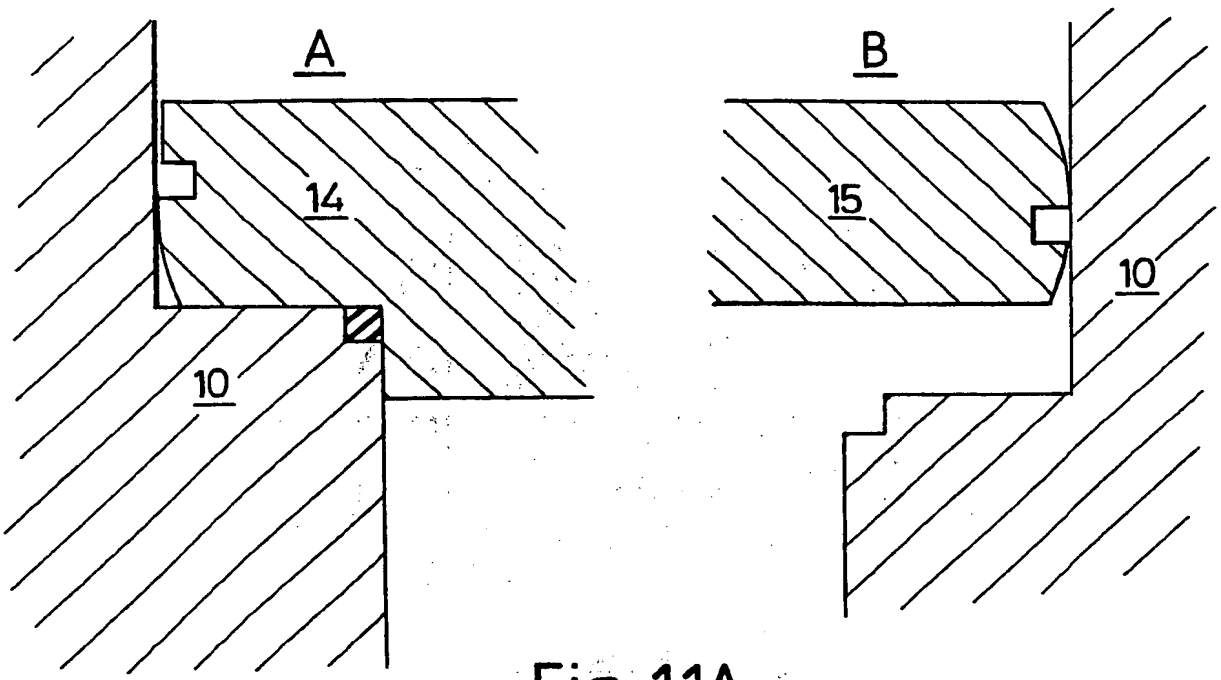


Fig. 11A

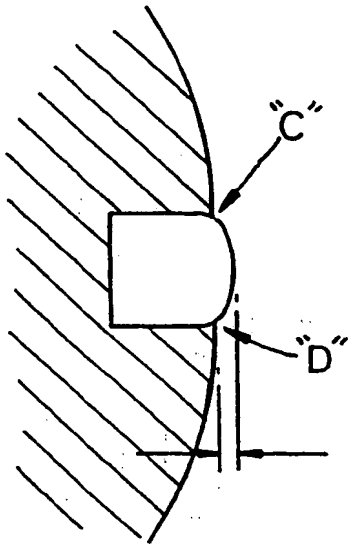


Fig. 11B

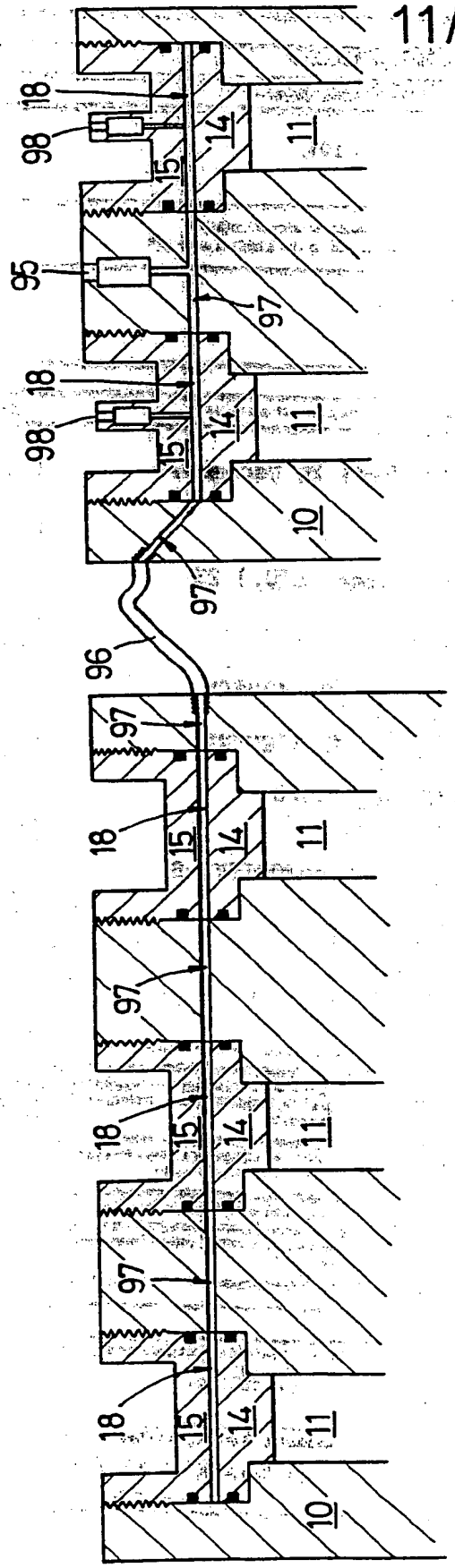


Fig.12

INTERNATIONAL SEARCH REPORT

PCT/GB 92/00704

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 F16J13/02; F16J15/40; F04B21/00; F16L37/10

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	F16J ; F04B ; F16L

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	GB,A,885 314 (MULLER & SCHAFHAUSEN) 28 December 1961 see the whole document	1,3,5,6, 8,9
X	GB,A,1 175 056 (I.W.S. NOMINEE COMP. LTD.) 23 December 1969	1,3,8,9
A	see the whole document	7
X	FR,A,1 585 213 (DIVCON INT. LTD.) 16 January 1970 see page 2, line 8 - page 7, line 9; figures	1,2,9
X	US,A,4 075 787 (KRAHE) 28 February 1978 see the whole document	1,3,4,9
X	GB,A,1 284 601 (U.K. ATOMIC ENERGY AUTORITY) 9 August 1972 see the whole document	1,3,6,9

° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
27 AUGUST 1992	14. 09. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	VON ARX H.P.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9200704 SA 58651

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 27/08/92
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-885314		None	
GB-A-1175056	23-12-69	None	
FR-A-1585213	16-01-70	DE-A- 1750949 NL-A- 6808770 GB-A- 1223846	13-05-71 23-12-68 03-03-71
US-A-4075787	28-02-78	None	
GB-A-1284601	09-08-72	None	

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82